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The Value of Private Safety Versus the Value of Public Safety

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Abstract

In this study, one group of respondents is offered to purchase a safety device to be installed in their cars, while another group is offered a public safety program (improved road quality) which results in the same size risk reduction. In terms of the value of a statistical life, our results are very reasonable. However, the WTP for the private safety device is *higher* than the WTP for the public safety measure. Drawing on a model developed by Jones-Lee (1991), we show that some types of altruists may, but need not, be willing to pay more for a private risk reduction than for a uniform risk reduction of the same magnitude. Still, our empirical results are surprising, and further empirical research seems warranted.

Key words: safety, willingness to pay, altruism, environment, traffic

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It is often claimed that people are concerned not only with their own welfare but also with the welfare of others. Even if a person is unaffected by a particular project, he may be concerned about the project's impact on the welfare of others, i.e., express altruistic concerns.[1] Such altruistic concerns are usually not valued on the market and are hence difficult to capture using market data, i.e., it is difficult to estimate from market data the *total* monetary value which people place on changes in morbidity and mortality risks, for example. The contingent valuation method, CVM for short, has therefore become an important tool for evaluating health outcomes and other changes caused by pollution and programs such as public safety expenditures and medical treatments.

In a recent article, Milgrom (1993), drawing on results derived by Bergstrom (1982), has argued forcefully that one can ignore altruistic components in a social cost-benefit analysis. In terms of a project affecting people's safety, Milgrom thus implicitly claims that one should ask people about their willingness to pay for changes in their *own* safety. Moreover, in two recent articles, Jones-Lee (1991, 1992) has derived a set of results on the valuation of a statistical life in the presence of different kinds of altruism; the value of a statistical life is the aggregate WTP for a project expected to save one life. In particular, Jones-Lee shows that one should take full account of people's willingness to pay for the safety of others if and only if altruism is exclusively safety-focused, in the sense that people care about the safety of others but ignore other dimensions of their welfare. If altruism is pure in the sense that people care about the level of welfare attained by others, one can simply ignore WTP for improvements in the safety of others, i.e., concentrate on the value of statistical life. The intuition behind this result is that the pure altruist values both benefits and costs that accrue to others (the overall change in utility). These benefits and costs net out if we are close to a social welfare optimum.

In CVM experiments, people typically pay a uniform amount of money for a public (safety) project. In this article, we show that a pure altruist's *total* WTP for such a project can exceed or fall short of his WTP for a change in his own safety, depending on whether he believes that his own WTP falls short of or exceeds the WTP of others. Let us assume that he is willing to pay $\$t$ for a ceteris paribus increase in his own safety. His total WTP for a uniform public risk reduction of the same magnitude will fall short of $\$t$ if he believes that others are willing to pay less than $\$t$ but will still be forced to pay that amount ($\$t$) for the project. This is because those other individuals, for whom he cares, will then experience a lower utility if the program is implemented. In turn, this decrease in the utility of others reduces the pure altruist's WTP for the public safety project. To our knowledge, this fact has been overlooked by previous authors within the field.

We also report an empirical study, in which automobile owners are asked about their WTP for private and public measures aimed at reducing traffic risks. In previous empirical studies, such as Jones-Lee et al. (1985) and Viscusi et al. (1988), respondents have been asked about their WTP for improvements in their own safety due to a private safety measure. Altruistic components of value were elicited with a second valuation question concerning respondents' WTP for a public safety program. The drawback of this approach is that the answer to a second valuation question may be influenced by the answer to the first valuation question.

For this reason, we use two different samples of respondents. One group of car owners is asked a dichotomous choice question concerning their WTP for a private safety device that reduces, by x percent, the risk of a traffic fatality for those travelling in the car. A second group of car owners are asked a similar WTP question concerning a public safety measure: improved road quality that reduces, by x percent, their own risk (and the risk for all other road users) of a traffic fatality. By design, the two proposals differ only with respect to who receives the benefits of the risk reduction: the car owners and his passengers, in the case of the private safety device, or all road users, in the case of the public program. Any difference between the WTP for the measures should thus be attributable to inter-household altruistic motives (since we are able to control for the perceived impact of the public safety project on the environment). Respondents are also asked about their perceived relative risks of a traffic fatality in order to test if WTP increases with the perceived risk level.

This article is structured as follows. Section 1 presents a theoretical model used as a point of departure for the empirical study. In section 2, we present the methodological approach used in the empirical part of the study, while section 3 presents the results of the empirical study. The article ends with some concluding remarks.

1. The theoretical framework

The Hicks–Allais type of model used in this section is due to Jones-Lee (1991, 1992). It is a simple single-period model in which individuals, as viewed from the beginning of the period, face two possible future states of the world: being alive or being dead. Given the purpose of this article, using such a simplified model saves us from an unnecessarily complex mathematical presentation without loss of generality. It is assumed that individuals have preferences over their own survival probabilities and levels of wealth, and those of others. We also assume that individuals are concerned about the quality of the environment. The reason for introducing this assumption is the fact that we are considering projects which may affect pollution of the environment. In order to simplify the notation, we aggregate individuals into two broad categories: the considered individual (including any of his household members), in what follows denoted as individual No. 1, and all other individuals, in what follows denoted as individual No. 2. The well-behaved cardinal utility function of the considered individual (household) is written as follows:

$$V_1 = V_1(\pi_1, y_1, \pi_2, y_2, z) \tag{1}$$

where π_1 is a vector of the survival probabilities of the individuals belonging to the household of the considered individual, and y_1 is his (or alternatively his household's) wealth; while π_2 and y_2 are the corresponding figures for the second individual, and z is an index reflecting environmental quality. The function $V_1(.)$ is assumed to be strictly increasing in π_1 and y_1, and nondecreasing in π_2, y_2, and z. As noted by Jones-Lee (1992, p. 82), this formulation of the utility function is sufficiently general to include as special cases virtually all of the main approaches to the treatment of choice under uncertainty, for example, the expected utility approach. Note also that if the considered individual (household) is purely selfish, then $\partial V_1(.)/\partial\pi_2 = 0$ and $\partial V_1(.)/\partial y_2 = 0$, while they are strictly positive if he is a pure altruist.[2] If $\partial V_1(.)/\partial\pi_2 > 0$ while $\partial V_1(.)/\partial y_2 = 0$, the individual is said to be a paternalistic or safety-focused altruist, since he cares about only one aspect of others well-being, namely, their safety (here ignoring environmental quality). It should be pointed out, however, that safety-focused altruism is just one (rather extreme) form of paternalistic altruism. For example, another (equally extreme) form of paternalistic altruism is wealth-focused altruism, in which one cares only about others income or wealth and is indifferent to variations in their safety.

In what follows, we will concentrate on inter-household altruism. This seems to be the form of altruism of which people most often think when they refer to altruistic motives, for example, within public safety and environmental contexts. Let us now consider two different traffic safety projects which both change survival probabilities from π_{h0} to π_{h1} for $h = 1, 2$, where a subscript 0 (1) refers to before project (with project) values. The first project or measure is purely private but affects all users of a car in the same way, such as an airbag which can be purchased in the market and provides a uniform risk reduction for the driver and his passengers. The second project is a pure public safety measure, such as improving the quality of roads in the country. This public safety program is assumed to cause a uniform risk reduction for all road users.

The considered individual, who in the empirical study is a car owner, is asked about his/her willingness to pay for the two projects.[3] Firstly, we inquire about his/her willingness to pay for a purely private safety measure. Secondly, he/she is asked about his/her WTP for the public safety project. In the latter case, the payment vehicle is a uniform tax increase for all car owners. Using (1), we arrive at the following two money measures:

$$V_1(\pi_{11}, y_{10} - p_1, \pi_{20}, y_{20}, z_0) = V_{10} \tag{2}$$

$$V_1(\pi_{11}, y_{10} - t_1, \pi_{21}, y_{20} - t_1, z_0) = V_{10}$$

where V_{10} is the initial (i.e., pre-project) level of utility of the considered individual, p_1 is his willingness to pay (noncontingent compensating variation) for the individual or private safety measure,[4] and t_1 is his noncontingent compensating variation for the public safety measure *provided* everybody else pays t_1 for the project in question: Recall that, by construction, every car owner must pay the same tax.

By assumption, the two safety measures affect all members of a household in the same way. Thus, if there is a difference between p_1 and t_1, it must be due to some kind of inter-household altruism (holding environmental quality z constant). A pure altruist would report $p_1 < t_1$ if the tax t_1 is such that the welfare of the second individual is improved. This is so because a pure altruist positively values the fact that the welfare of the second individual is increased by the public safety project. However, if he believes that t_1 approximates the willingness to pay of the second individual (t_2), it holds that $p_1 = t_1$. The reason is simply the fact that if $t_1 = t_2$, then the second individual remains at his initial level of utility. In this case, in both lines of (2), the second individual stays at his initial level of utility. Thus, it must hold that $p_1 = t_1$ if the first individual is a pure altruist and $t_1 = t_2$. Finally, if $t_1 > t_2$, it holds that $p_1 > t_1$. In other words, $p_1 > t_1$ if $t_1 > t_2$, while $p_1 \leq t_1$ if $t_1 \leq t_2$. To the best of our knowledge, previous authors asking people to pay for non-use or passive use values have overlooked this complication of using a uniform tax as the payment vehicle when individuals are pure altruists. Our rough way of handling this complication in the empirical study is by asking a follow-up question, where we inquire whether respondents believe that they are willing to pay more or less than the average car owner.

If the considered individual is a safety-focused altruist, then $p_1 < t_1$, since such a person cares only about a project's impact on the survival probabilities of others, i.e., does not care about the utility/wealth of others per se, and the second-line project, but not the first-line project, in (2) raises the survival probability of others. On the other hand, if he is a wealth-focused altruist, he would report $p_1 > t_1$, since the public safety program reduces the wealth of those he cares for. Finally, if he is strictly selfish, then $p_1 = t_1$.

Our valuation questions refer to a percentage reduction of the risk of being killed in a traffic accident. This fact means, ceteris paribus, that the WTP for the private measure, i.e., p_1, should be larger, the larger are the risks which the individual faces in traffic. Similarly, *if* the high-risk road user believes that he gains more from the considered public safety program than the average road user, he will report a WTP, which, ceteris paribus, exceeds the average WTP. By asking individuals about the traffic risks which they face, we can test these hypotheses.

A project improving the quality of roads may increase traffic and hence increase pollution. If people who are concerned about the magnitude of z (see (1)) believe that the considered public safety program will reduce environmental quality, their WTP will be lower than t_1 in (2). However, by asking respondents if they believe that the considered program will affect the quality of the environment, we are able to test this hypothesis. This concludes the presentation of the theoretical framework of the study.

2. Methods

Our valuation questions were included in a general population telephone survey of 2,000 individuals aged 16 years and older in Sweden. Only car owners in a household with one car received our questions. In total 1,067 car owners were interviewed. The survey was carried out by a professional survey firm (SIFO AB) in September/October 1995.

The sample was randomly divided into two subsamples which each received one of the valuation questions. The respondents in the first subsample were asked about their willingness to pay for a private safety device:

"In Sweden 600 persons die annually in traffic. A possible measure to reduce the traffic risk is to equip cars with safety equipment, such as airbags.

Imagine a new type of safety equipment. If this equipment is installed in your car, the risk of dying in a traffic accident will be cut in half for you and everyone else travelling in the car. This safety equipment must be reinstalled each year to work.

Would you choose to install this safety equipment in your car if it will cost you SEK B per year?

.... YES
... NO"

The 600 road deaths refer to all road users. The respondents in the second subsample were asked about their willingness to pay for a public safety measure. This question was intended to be identical to the first with the exception that now the risk would be reduced by 50% for *all road users*. This question was phrased in the following way:

"In Sweden 600 persons die annually in traffic. The number of deaths can be reduced if we devote more resources to preventing traffic accidents. We can, for instance, straighten out bends, build safer crossings, and increase the supervision of traffic.

Imagine a program that halves your, but also other road users', risk of dying in a traffic accident. Are you willing to pay SEK *B* per year more in taxes on your car for this program?

.... YES
.... NO"

In both willingness-to-pay questions, the following six bids were used in SEK (Swedish Crowns; \$1 = SEK 6.60, £1 = SEK 10.20 in January 1996): 200, 1,000, 2,000, 5,000, 10,000, and 20,000.

In a follow-up to the yes/no question, we asked respondents who answered "yes" if they were "fairly sure" or "absolutely sure" that they would pay. Our hypothesis is that only those individuals who are certain of their yes response would be likely to pay in a real decision situation. This approach allows a more conservative estimation of willingness to pay where only the respondents that are certain of their yes response are interpreted as truly accepting the bid. Ready et al. (1995) found that replacing the pure binary yes/no alternatives by several yes/no alternatives (yes definitely, yes probably, etc.) may affect the overall proportion of yes answers. Our approach, where we ask a pure binary yes/no question and then follow up by inquiring whether the yes answer is certain or uncertain, avoids this complication. Johannesson et al. (1995), in an experiment, found that the real average WTP (for a particular brand of chocolate) was overestimated by the conventional hypothetical binary yes/no question but underestimated if only absolutely sure yes responses were considered as corresponding to a purchase decision in a real situation. With the exception of the follow-up question, that experiment is a replication of the experiment reported in Cummings et al. (1995). In this study, we estimated the WTP both in accordance with the standard interpretation of the yes responses and the more conservative interpretation of the yes responses.

We also asked the respondents if they thought that their risk of being killed in a traffic accident was lower, the same, or higher than that of the average driver. This question was included to test the hypothesis that willingness to pay increases with the perceived risk level.

A problem in comparing the willingness to pay between the private and the public safety measures is that respondents may believe that the public program has effects other than risk reduction. One possibility is that respondents expect the public program to affect the environment (through an impact on traffic volume, for example). To account for this possible confounding effect, we included a question about the perceived impact of the public safety program on the environment. The respondents were asked if they thought the program would improve, worsen, or have no effect on the environment. Information about the following socioeconomic variables—age, sex, education, household size, and household income—was also collected in the survey.

3. Results

For the private safety measure, 82% agreed to pay the lowest bid of SEK 200 in the study, and 9% agreed to pay the highest bid of SEK 20,000. If only "absolutely sure" responses are counted, these proportions decrease to 66% and 1%, respectively. For the public safety measure, 63% agreed to pay the lowest bid of SEK 200 in the study, and 7% agreed to pay the highest bid of SEK 20,000. If only "absolutely sure" responses are counted, these proportions decrease to 43% and 3%, respectively. Of all respondents answering "yes," 52% were "absolutely sure" of their responses.

In estimating the probability of agreeing to pay a specified amount of money B in exchange for the considered project, i.e., a change in the survival probability from π_{h0} to π_{h1} for $\forall h$, we assume a logistic model. The acceptance probability P is written as follows:

$$P = F(B) = 1/[1 + e^{-\Delta v}], \tag{3}$$

where $F(B)$ is the "survivor" function yielding the probability of accepting to pay at least \$$B$ in exchange for the project, and Δv is the change in utility caused by the considered improvement in safety if the person pays \$$B$ for the improvement. In what follows, we assume a linear approximation of the change in utility: $\Delta v = \gamma_0 + \gamma_1 B + \gamma_2 \boldsymbol{S}$, where γ_0 is interpreted as the change in utility caused by a ceteris paribus improvement in safety, $\boldsymbol{S}$ is a vector of socioeconomic factors, and γ_i for $i = 0,\ldots, 2$ are parameters to be estimated. Since we have three categories, i.e., those who are absolutely sure that they agree to pay a particular amount of money in exchange for the considered project, those who are fairly sure of their yes responses, and those rejecting the project at the proposed price, we have estimated ordered as well as conventional logistic models (i.e., with separate regressions for the standard and the conservative interpretations of the yes answers, respectively). In table 1, the results of the ordered logit regressions of the intention to pay for the risk reduction are shown. The conventional models produce similar results and are therefore not reported here, but the results are available from the authors.

The intention to pay for the safety measure based on the three possible responses was used as a dependent variable (with 1 = reject to pay, 2 = fairly sure yes response, 3 = absolutely sure yes response). The regressions were estimated using maximum likelihood methods (in Stata). We report two goodness-of-fit measures: the percentage of correctly predicted responses and the likelihood ratio index (Greene, 1993).

The bid is highly significant with an expected negative sign in both the regression for the private safety measure and the regression for the public safety measure. Income is also highly significant in both regressions, showing that the probability of accepting a given bid increases with income. Other socioeconomic variables are not statistically significant, with the exception of sex in the regression for the public safety measure (indicating that the probability of agreeing to pay for the public safety program is higher for women than for men).

Table 1. Results of ordered logit regression of the intention to pay for a safety measure (ordered response: 1 = rejects to pay, 2 = fairly sure yes response, 3 = absolutely sure yes response). Standard errors are shown within parentheses

Regressor variable	Safety measure	
	Private	Public
Bid	−0.00024***	−0.00017****
	(0.000032)	(0.000028)
Sex[a]	−0.11	0.48**
	(0.23)	(0.24)
Age	−0.012	0.00013
	(0.0076)	(0.00049)
Household size	0.079	−0.026
	(0.14)	(0.22)
Education[b]	−0.058	−0.057
	(0.28)	(0.27)
Household income[c]	0.032**	0.050***
	(0.014)	(0.015)
Average risk[d]	0.28	0.092
	(0.25)	(0.24)
Higher than average risk	0.96*	0.50
	(0.49)	(0.46)
No effect on the environment[e]		−0.26
		(0.45)
Improved environment		0.69
		(0.44)
Cut 1[f]	−0.26	1.58***
	(0.61)	(0.59)
Cut 2[g]	0.73	2.90***
	(0.62)	(0.61)
No. of obs.	389	410
Log-likelihood	−290.95	−289.52
Individual prediction (%)	69.64	70.00
Likelihood ratio index	0.19	0.15

***,**,* = Significant at 1%, 5%, and 10% levels (two-tailed test).
[a]: 1 = woman, 0 = man.
[b]: 1 = ≥high school, 0 = otherwise.
[c]: Thousand SEK/month (pre-tax).
[d]: lower than average risk baseline category.
[e]: worsened environment baseline category.
[f]: = $-\gamma_0$; standard interpretation of the yes responses
[g]: = $-\gamma_0$; conservative interpretation of the yes responses.

The dummy variable indicating the group who perceives their traffic risk to be average has the expected positive sign in both regressions (lower than average is the omitted category), but is not statistically significant. The dummy variable for the group with a higher than average perceived risk also has an expected positive sign, but is only statistically significant in the regression for the private safety measure. Perhaps, it is more difficult for a respondent to relate his own risk level or behavior as a driver to a national public safety program than to a private safety device. The dummy variable for the perceived effect on the environment included in the regression for the public safety measure is not statistically significant according to a two-tailed test. (The coefficient for an improved environmental quality is significant according to a one-tailed test. Such a test is appropriate if the hypothesis is that an improved environmental quality increases the acceptance probability. Moreover, there are only about 35 observations in the baseline category. The coefficient of a dummy, taking on the value one if the environment is improved and zero if not, is positive and significant at the 1% level according to a two-tail test.)

We have used the parameters reported in table 1 to estimate the mean WTP for the two programs. However, as can be seen from (3), the regression equations predict that a certain proportion of respondents have a negative WTP, since P will approach one as B approaches minus infinity. However, safety equipment is a private commodity, which you freely may or may not elect to buy. For this reason, we rule out a negative WTP in the estimation of the mean WTP for the private safety measure. WTP is set equal to zero for the proportion of respondents who are predicted to have a non-positive WTP. In the case in which the WTP is non-negative, but in which the probability of a zero WTP is strictly positive, the mean willingness to pay is equal to (see Johansson, 1995; O'Conor, 1995):

$$p^M = \int_0^\infty [1/(1 + e^{-(\gamma_3+\gamma_1 B)})]dB = -(1/\gamma_1)\, ln[1 + e^{\gamma_3}], \tag{4}$$

where p^M denotes the mean WTP for the private safety measure and γ_3 denotes the magnitude of the constant term in (3) when the elements of $\boldsymbol{S}$ are assigned particular values. We have used (4) to estimate the mean WTP, denoted t^M, for the public safety measure as well.

The results are reported in table 2. The mean WTP for a program was estimated with the explanatory variables set at their sample means. Thus, we are estimating WTP for an average respondent across the two programs. The standard error of the mean WTP was estimated using a Taylor series approximation (Kmenta, 1986). To test if there was a statistically significant difference in the mean WTP, we used a two-tailed independent samples t-test (Newbold 1991).

The mean WTP for the private safety measure is about SEK 4,700 based on the standard estimation, and about SEK 2,400 based on the conservative estimation. The mean WTP for the public program is about SEK 3,900 based on the standard estimation, and about SEK 1,300 for the conservative estimation. For the conservative (standard) estima-

Table 2. The estimated mean willingness to pay (WTP) for private and the public safety measures. Standard errors are reported within parentheses. In SEK ($1 = SEK 6.60, £1 = SEK 10.20 in January 1996).

WTP estimation	Safety measure		WTP difference
	Private (p^M)	Public (t^M)	($p^M - t^M$)
Standard	4,687 (499)	3,903 (504)	784 (709)
Conservative	2,403 (315)	1,322 (233)	1,081 (392)***

***Significant at the 1% level (two-tailed test).

tion, the WTP for the private safety measure is (not) significantly higher than the WTP for the public safety measure. We also estimated the mean WTP based on a regression using only the bid on the right-hand side so that no respondents are excluded due to missing values of the explanatory variables. This estimation led to similar WTP amounts as those reported in table 2, but WTP differed significantly between the two programs according to the standard estimation (at the 10% level), as well as the conservative interpretation of affirmative responses. Additionally, we estimated the mean WTP for the public safety measure, given that there would be no impact on the environment (by setting the dummy variable on the environmental change to zero when using (4)). This led to a somewhat lower estimate of mean WTP for the public safety measure and, as a result, WTP differs significantly between the public and the private safety measure for both the standard and the conservative interpretations of yes responses.

Based on estimates of willingness to pay for the risk reduction, the implied value of a statistical life can also be estimated. If we assume that our respondents and their household members (or other car passengers) face the same death risks in traffic as the average Swede, the value per statistical life varies between SEK 30 million ($4.5 million) and SEK 59 million ($8.9 million) for private risk reduction.[5] For public risk reduction, the value per statistical life varies between SEK 17 million ($2.6 million) and SEK 49 million ($7.4 million). These estimates are on the same level as other estimates in the literature (Viscusi 1992, 1993). It should be stressed that these estimates assume that the respondents (which are car owners in households with one car) report household willingness to pay rather than their individual WTP. This assumption is very reasonable for Sweden, since most Swedish households have a joint budget (a fact that is not necessarily true for other countries). This is also confirmed by the strong influence of household income on the acceptance probability (see table 1). However, if a subset of respondents have reported their individual WTP, our estimate of the value of a statistical life provides only a lower bound for its "true" value (while its upper bound is approximately twice the magnitude reported above). In any case, we can see no strong reason why there should be a difference with respect to which WTP measure is reported between the two subsamples. Thus, the magnitude of the value of a statistical life for private risk reduction relative to the value of a statistical life for public risk reduction should be unaffected by the assumption whether an individual or a household WTP is reported.

The equations in table 1 can also be used to estimate the willingness to pay of individuals at different perceived risk levels. The dummy variable for perceived risk reduction is only statistically significant for private risk reduction. For private risk reduction, the standard (conservative) WTP is SEK 4,200 (SEK 2,100) for the individuals with a lower than average perceived risk, and SEK 7,200 (SEK 4,200) for individuals with a higher than average perceived risk. Thus, the perceived initial risk level has a strong impact on the WTP for a risk reduction. Overall, the respondents seem to underestimate their own risks. About 40% think that they have a lower than average risk, and 7% think that they have a higher than average risk. The remaining 53% think that they face about the same risk as the average Swedish driver.

In the case of a public safety measure, everyone is "forced" to pay, even if his/her WTP is negative, because, for example, he/she believes that the program will have a strong negative impact on the environment. For this reason, in one variation, we allow WTP $\in (-\infty, +\infty)$ as is, in fact, predicted by (3). Then, the average WTP is equal to $t^{Ma} = -\gamma_3/\gamma_1$, where t^{Ma} denotes the mean WTP for the public safety measure (see Johansson, 1995, for details). In this case, the mean WTP for the public safety program is either approximately zero (standard estimation) or negative (conservative estimation).

4. Concluding remarks

In the present study, the average WTP for the private safety device exceeds the average WTP for the public safety measure, a result that deserves some comment. According to our theoretical model, a pure altruist will report $p_1 > t_1$ if his WTP exceeds the WTP of others. Of our respondents, 33% (24%) believed that their own WTP exceeds (falls short of) the average WTP for the public safety measure, while 43% believed that their WTP is about the same as the average WTP. Thus, there is a tendency to overestimate one's own WTP relative to the WTP of others. This tendency should, ceteris paribus, cause the average WTP for the public safety program to fall short of the average WTP for the private safety device if respondents are pure altruists (see section 1 for details). Similarly, wealth-focused altruists will report $p_1 > t_1$, a fact which further lowers t^M relative to p^M, where a superscript M denotes the average or mean WTP. However, we don't know if these two groups of altruists "outweigh" the safety-focused altruists (for whom $t_1 > p_1$) to such an extent that p^M is (significantly) higher than t^M.

The result $p^M > t^M$ is not due to an expected negative environmental impact of the public safety program. About 90% of the respondents believed that the proposed public safety measure would either improve environmental quality or leave it unchanged. Possibly, the payment vehicle for the public safety measure, i.e., a tax increase for car owners, is considered to be unfair. After all, the proposed measure will increase safety for both car owners and other kinds of road users. Car owners in Sweden are heavily taxed and may feel that they already are subsidizing other road users. Since all car owners would have to pay the tax, there is also a demand effect. Some people would choose to sell their cars in response to a higher "car price," a fact which, ceteris paribus, reduces the average WTP. There is, of course, also the possibility that the valuation question failed for one reason or the other. In addition, the sample of respondents is quite small, implying that our results may be due to random factors which would "net out" if the sample size were increased. On the other hand, according to the results reported in table 1, the two valuation questions seem to have worked. In particular, the probability of acceptance is sensitive to the magnitude of the bid, to the level of income, to the risk level faced by the respondent, and to the perceived environmental impact of the public safety program.

Our results contrast sharply with those reported in some previous studies of the value of risk reductions. Both Jones-Lee et al. (1985) and Viscusi et al. (1988) report a positive mean WTP for altruistic concerns. However, there are several important differences between these studies and the one reported here. First, both Jones-Lee et al. (1985) and Viscusi et al. (1988) use open-ended question formats, while we use a closed-end format. Second, in contrast to earlier studies, we specify how much other households, besides the respondent's, must pay for the public safety program; the payment vehicle is a uniform tax on cars. Third, in order to avoid the possibility of a kind of "anchoring" effect, where the answer to the second question (typically the altruism question) is influenced by the answer to the first question (typically the private risk reduction question), our respondents were asked only one valuation question, not two or more as is the case in previous studies. Fourth, in contrast to Viscusi et al. (1988), in the public safety valuation question we did not translate the risk reduction caused by the public safety program into the number of fatalities avoided. The reason was that we feared that including such information in one but not the other of the valuation questions could cause a difference in the respondents' perceptions of the magnitudes of the programs. Thus, there are important differences between the studies, a fact which, at least in part, may explain the different results.

Jones-Lee et al. (1985) found a positive mean WTP for altruistic concerns for other car occupants (i.e., presumably intra-household altruism rather than inter-household altruism). However, the Jones-Lee et al. study also had a pure public goods question in which the value of a statistical life implied by the mean response was much lower than in the private goods question. Jones-Lee et al. interpreted this difference as evidence of free-rider effects, an interpretation that may be relevant for the results in the present study. That is, without a detailed attitudes survey which fully captures the reasons behind a person's response to our valuation question, we cannot rule out the possibility that the differences reported in table 2 are attributable to a public goods free-rider effect rather than to pure altruism and perceived overpayment by others or wealth-focused altruism. However, a respondent may overstate or understate his true WTP based on strategic considerations, depending on what part of the project, e.g., its magnitude or his own payment obligation, he expects to affect. Thus, in general, it is unclear whether strategic behavior would tend to increase or decrease mean WTP. Moreover, in contrast to Jones-Lee et al. (1985), we use a closed-end valuation technique. With such an approach, it is not obvious that strategic behavior can be expected to influence the outcome of the valuation experiment. Although we cannot completely rule out the possibility that our results are affected by some kind of strategic behavior, the empirical results are striking and highlight the theoretical complication of using a uniform tax as a payment vehicle in public good valuation surveys.

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Notes

1. There are also theories of impure altruism, for example, Andreoni's (1990) theory of warm-glow giving, but these approaches are not addressed here.
2. A pure altruist respects the preferences of others. This means that $(\partial V_1(.)/\partial\pi_2)(\partial V_1(.)/\partial y_2) = (\partial V_2(.)/\partial\pi_2)(\partial V_2(.)/\partial y_2)$.

3. In the empirical analysis, we use different samples for the two (dichotomous-choice) questions in order to avoid an "anchoring" effect, i.e., the problem that the answer to a second WTP question is influenced by the answer to the first question.
4. This is a discrete commodity, i.e., it is either purchased or not, explaining the fact that we have chosen to deduct p_1 (times one) from income.
5. The value of a statistical life is here defined as the mean household WTP (from table 2) divided by (300/3,700,000). There are about 3.7 million households in Sweden, and halving the risk of dying in a road accident would save 300 lives. We use average household data, since no death risk data are available for households with one car.

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